

# **Gravina Access Project**

## ***Effects on Cruise Ship Operations***



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## **Executive Summary**

This technical memo presents the analytical process used to estimate potential impacts of each Gravina Access Project reasonable alternative to the cruise ship industry. The process involved a review of several technical memoranda prepared for the project that included cruise ship traffic projections for the study period, surveys of cruise lines, analysis of cruise ship running times, and cruise ship simulations in the Tongass Narrows area. The results from this technical memorandum are used in the subsequent economic effects memorandum, which uses this data and the cruise ship traffic projections to forecast the indirect economic effects to the cruise industry through the study period.

As with any exercise where scenarios about the future are discussed, a certain amount of caution is necessary when viewing the results. This analysis presents a range of possibilities based on information known at this time and certain assumptions about future events. While it is possible to identify potential impacts, such as the ones described in this analysis, it is not possible to know exactly what will happen with a particular Gravina Access Project alternative. The ultimate outcome depends on the decisions of the State of Alaska, federal government agencies, the cruise industry, and a variety of factors including market forces and world political events.

Table ES - 1 and Table ES - 2 summarize the range of estimated operational and financial impacts of each access alternative, using the level of cruise ship activity in 2001 as a base year. Certain bridge alternatives may affect cruise ship operations by requiring more time to access the port, potentially reducing the time cruise ships on fixed schedules are able to spend in port or the number of calls to the Port of Ketchikan. Reductions in port calls and time in port would result in lower expenditures in Ketchikan by the cruise lines, their passengers, and their crew.

Three scenarios were developed for each bridge alternative: a low case representing the fewest effects, a base case representing a mid-range scenario, and a high case representing the greatest effects. Following the analysis, it was concluded that three Gravina access alternatives would have an on-going effect on the cruise ship industry. These alternatives include C3(b) and D1 – both 120-foot high bridges over Tongass Narrows in the vicinity of the airport, and F3 – a Pennock Island alternative consisting of a 60-foot high bridge over East Channel and a 200-foot high bridge over West Channel.

Table ES-1 summarizes the effects of the alternatives on the number of cruise ship port calls. For alternatives C3(b) and D1 (120-foot high bridges), there are no reductions in the number of port calls projected in the low case, 2% fewer port calls in the base case, and 6% fewer port calls in the high case. Initially, for alternative F3 (Pennock Island crossing), there are no reductions in the number of port calls projected in the low case, 4% fewer port calls in the base case, and 15% fewer port calls in the high case. Following an adjustment period of two to three years after completion of the F3 alternative, it is anticipated that some cruise ships would resume calling at Ketchikan. Following this period, the number of port calls with the base case would be lower by 2% rather than 4%, and for the high case the number of port calls would be lower by 8% rather than 15%.

Table ES - 2 summarizes the effects of the alternatives on passenger, crew, and cruise ship expenditures as a result of fewer port calls and reduced port time. For alternatives C3(b) and D1, expenditures are projected to decrease by about \$0.7 million in the low case, \$2.2 million in the base case, and \$5.2 million in the high case. Initially, for alternative F3, expenditures are projected to decrease by \$0 million in the low case (no impact), \$3.2 million in the base case, and \$10.9 million in the high case. Following the adjustment period, expenditures would remain lower by \$0 million in the low case (no impact), \$1.5 million in the base case, and \$5.5 million in the high case.

**Table ES - 1. Reduction in Number of Port Calls – 2001 Base Year**

<b>Alternative</b>	<b>Description</b>	<b>Low</b>	<b>Base</b>	<b>High</b>
No Action	Existing ferry service	None	None	None
C3(a)	200-foot High Bridge – Airport Area to Signal Road	None	None	None
C3(b)	120-foot High Bridge – Airport Area to Signal Road	None	2%	6%
C4	200-foot High Bridge – Airport Area to Cambria Drive Area	None	None	None
D1	120-foot High Bridge – Airport Area	None	2%	6%
F1	Pennock Island Crossing – 200-foot High Bridge East Channel & 120-foot High Bridge West Channel	None	None	None
F3 Initial Period	Pennock Island Crossing – 60-foot High Bridge East Channel & 200-foot High Bridge West Channel	None	4%	15%
F3 After Adjustment	Pennock Island Crossing – 60-foot High Bridge East Channel & 200-foot High Bridge West Channel	None	2%	8%
G2	Ferry Route from Peninsula Point	None	None	None
G3	Ferry Route from Downtown Ketchikan	None	None	None
G4	Ferry Route Adjacent to Existing Ferry	None	None	None

**Table ES - 2. Reduction in Cruise-related Expenditures – 2001 Base Year (\$Million)**

<b>Alternative</b>	<b>Description</b>	<b>Low</b>	<b>Base</b>	<b>High</b>
No Action	Existing ferry service	\$0	\$0	\$0
C3(a)	200-foot High Bridge – Airport Area to Signal Road	\$0	\$0	\$0
C3(b)	120-foot High Bridge – Airport Area to Signal Road	\$0.7	\$2.2	\$5.2
C4	200-foot High Bridge – Airport Area to Cambria Drive Area	\$0	\$0	\$0
D1	120-foot High Bridge – Airport Area	\$0.7	\$2.2	\$5.2
F1	Pennock Island Crossing – 200-foot High Bridge East Channel & 120-foot High Bridge West Channel	\$0	\$0	\$0
F3 Initial Period	Pennock Island Crossing – 60-foot High Bridge East Channel & 200-foot High Bridge West Channel	\$0	\$3.2	\$10.9
F3 After Adjustment	Pennock Island Crossing – 60-foot High Bridge East Channel & 200-foot High Bridge West Channel	\$0	\$1.5	\$5.5
G2	Ferry Route from Peninsula Point	\$0	\$0	\$0
G3	Ferry Route from Downtown Ketchikan	\$0	\$0	\$0
G4	Ferry Route Adjacent to Existing Ferry	\$0	\$0	\$0

## **1.0 Introduction and Purpose**

The Alaska Department of Transportation and Public Facilities (DOT&PF) through the Gravina Access Project is endeavoring to improve access to Gravina Island from Ketchikan, Alaska – the main population and commercial center in southern Southeast Alaska. Eighteen bridge, tunnel, and ferry options were originally considered, including the No Action Alternative. Ten alternatives, including the No Action Alternative, were selected for more detailed study from the many alternatives considered.

The purpose of this memorandum is to explain the possible primary effects of the ten reasonable access alternatives on the cruise ship industry and the indirect effects on the cruise lines and the Ketchikan community. The various bridge alternatives are expected to have different impacts to cruise ship use of Tongass Narrows, potentially necessitating routing changes, additional maneuvers, reduced port time, and higher cruising speeds (and fuel costs) to regain time lost entering or leaving the Ketchikan dock area. Because the potential loss of port time may reduce time available for shore excursions, cruise ships calling at Ketchikan may realize less revenue from the on-board sale of shore excursions and attractions. As a result, the cruise lines may choose to reduce port calls in Ketchikan in favor of longer and potentially more profitable port calls in Juneau, Skagway, or other ports.

For this analysis, a number of tasks were undertaken, beginning with a review of historical cruise ship industry growth in Ketchikan, followed by a projection of that growth into the future. A detailed survey of the major cruise lines calling in Ketchikan was conducted to understand the operational aspects of entering and leaving the Ketchikan port as well as operations between Ketchikan and Juneau. Part of this survey was an inquiry of marine operations officials into the impact of the various access options on ship movements. Cruise line officials with authority over shore excursion sales and related matters were also questioned to assess the effect of lost port time on operations and how companies might react to those potential economic impacts. Analyses were conducted related to transit times for ships between Vancouver, Ketchikan, and Juneau to assess the potential to make up additional transit times needed for certain alternatives.

The information and data gathered in these and related surveys and research provided the basis for the assumptions used in section 3.0 *Effects on Cruise Ship Operations*. These assumptions allowed the study team to estimate the potential number and extent of port calls that might be affected by various Gravina access options and estimate the cost of any potential increase in running speed.

In section 4.0 *Effects on Passenger Activities and Other Revenues*, the estimates developed in section 3.0 were used to calculate the reduction in shore spending by passengers and crew, and the revenue loss to the port and other enterprises as a result of reduced expenditures by the cruise lines themselves. These calculations were based on prior research into passenger, crew, and cruise line expenditures in Ketchikan.

## **2.0 Background**

### **2.1 Introduction**

The Gravina Access Project alternatives are expected to have a range of effects on the operations of cruise ships. In order to better understand the potential effects of each alternative, project team members prepared preliminary analyses studying various types of effects. This section provides a summary of these analyses. Supporting information can be found in the reference documents.

Several tasks were completed in order to understand how cruise ship operations could be affected by various crossing options. One task involved projecting cruise ship traffic to Ketchikan with no impacts to cruise ship traffic for the study period. The full analysis of the cruise ship projections can be found in the memo “Cruise Ship Traffic Projections Technical Memorandum,” by Glosten Associates, dated September 2001.

A second task consisted of interviews with cruise line executives responsible for making cruise ship deployment and itinerary decisions. A related undertaking was a survey distributed to cruise ship masters (ship captains) on the Alaska route during June 2001. Results of these latter two tasks are included in three internal memos from Klugherz & Associates to Northern Economics and HDR Alaska, Inc., dated May 31, 2001, July 28, 2001, and September 8, 2001.

Following the cruise line interviews and surveys, Glosten Associates, Inc., prepared a refined analysis of additional sailing and maneuvering time caused by each access option for ships traveling between Ketchikan and Juneau, the most typical cruise itinerary. The results of this analysis are found in an internal memo from Glosten Associates to HDR Alaska, Inc., dated August 29, 2001. Further, Glosten Associates prepared an analysis of transits between Ketchikan and Vancouver, British Columbia (B.C.) , using Seymour Narrows. The results of this analysis are found in a technical memo from Glosten Associates, Inc., dated October 2002.

Two other tasks were undertaken to further define the potential impacts to the cruise ship industry. These two tasks involved simulation studies: one of the studies included fast-time computer simulations of cruise ship operations in the study area, while the other simulated cruise ship operations in “real-time.” An analysis of the real time simulation is found in the technical memo, “Real Time Navigation Simulation Study (STAR Center) – Draft” by Glosten Associates for HDR Alaska, Inc., dated August 2002.

### **2.2 Cruise Ship Traffic Projections**

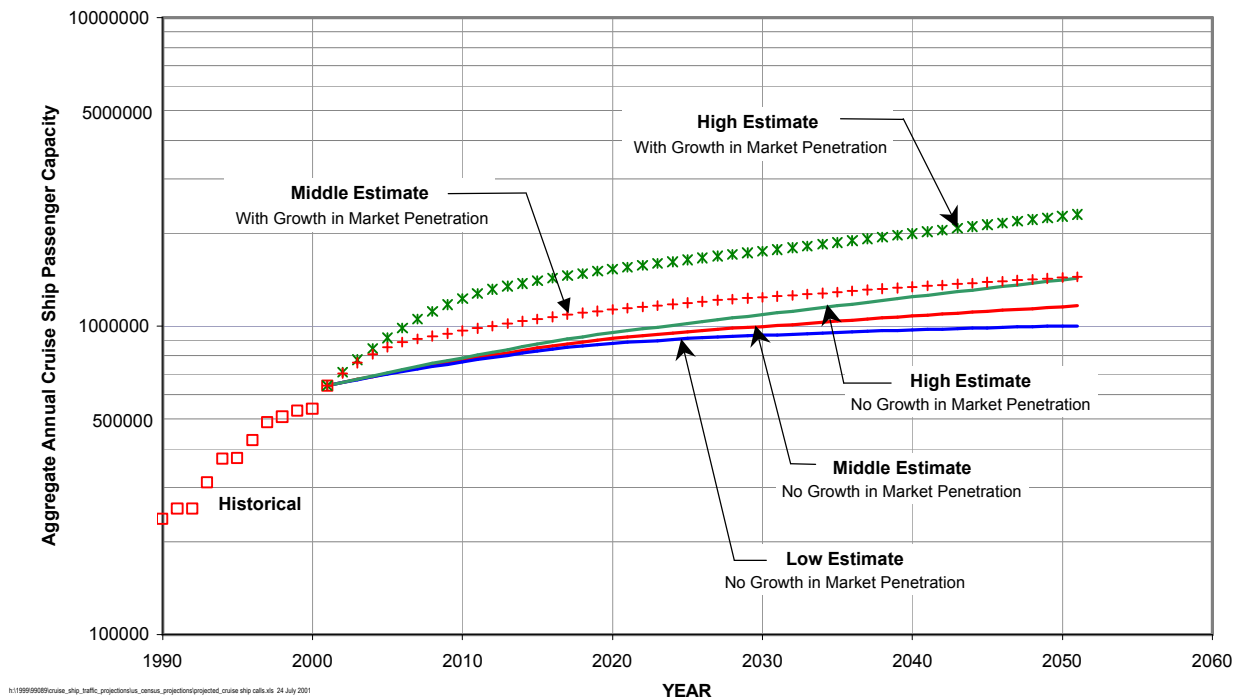
In a memo prepared prior to September 11, 2001, Glosten Associates, Inc., provided cruise ship traffic projections for Ketchikan through 2050. These projections are based on an analysis of historical cruise ship traffic to Ketchikan, population growth estimates provided by the U.S. Census Bureau, and international population trends. Two base assumptions underlie the cruise ship passenger and port call projections. The first assumption, used in three projections, is that cruise ship market penetration by age

remains constant at 1999 levels. The second, used in two projections, is that the pattern of growth in cruise ship market penetration over the past decade continues.<sup>1</sup>

The following is an excerpt from that memo which outlines the cruise ship passenger capacity projections shown in Figure 1.

Figure 1 depicts five different projections of the minimum aggregate annual cruise passenger capacity calling at Ketchikan. The high estimate with growth in market penetration exceeds one million passengers beginning in 2007 and two million passengers beginning in 2041 (note the logarithmic scale for passenger capacity). The middle estimate with growth in market penetration exceeds the one million mark beginning in 2012. In the absence of any further growth in market penetration, the one million passenger mark is passed in 2024, 2031 and 2051, respectively, by the high, middle, and low estimates.<sup>2</sup>

**Figure 1. Estimated Annual Cruise Ship Capacity for Cruise Ships Calling at Ketchikan**



The following excerpt from the memo outlines the cruise ship port call projections presented in Figure 2:

The high-series estimate with growth in market penetration exceeds 700 large cruise ship calls annually by 2019. The middle-series estimate with growth exceeds 500 large cruise ships by 2008, while the middle-series

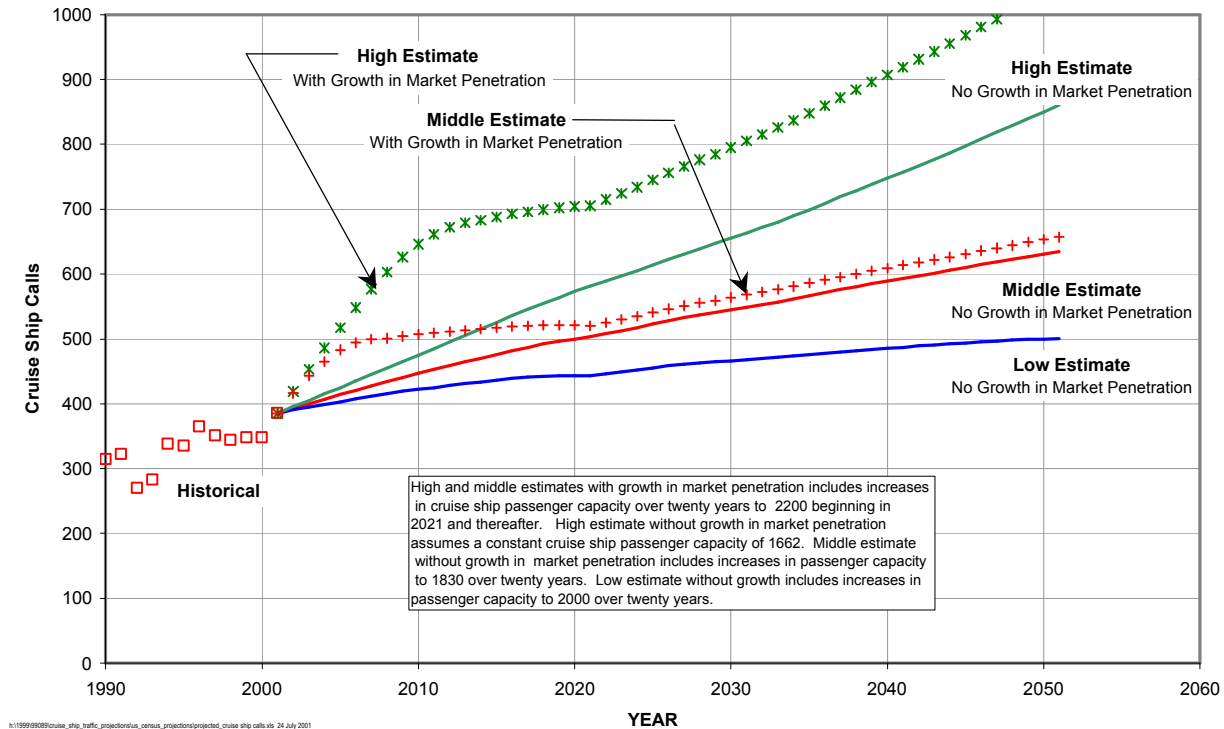
<sup>1</sup> Glosten Associates, Inc., *Cruise Ship Traffic Projections Technical Memorandum*, Draft, September 2001, pg. 5-1.

<sup>2</sup> Ibid, pg. 6-1.



without growth achieves 500 by 2020. The high-series estimate without growth exceeds 700 calls by 2036. Figure 2 depicts estimated cruise ship calls in Ketchikan from 1990 to 2051.<sup>3</sup>

Figure 2. Estimated Ketchikan Cruise Ship Calls



The Glosten memo concludes with the following:

High, middle, and low estimates of future large cruise ship traffic calling at Ketchikan, Alaska, have been developed, based on cruise ship demographic data, population projections, and historical market analysis. Planned large cruise ship traffic in 2001 comprises 385 port calls. The projections are for the period 2001 to 2051 and vary in 2051 from a low of 501 port calls to a high of 1,045, as shown in Figure [2-2].

A number of factors have been considered that might potentially limit the projected growth in cruise ship traffic. These factors are passenger income, limited cruise ship berthing space, resident resistance to increased tourism, inadequate growth in destination attractions, competition from other destinations, and large-ship traffic congestion in Tongass Narrows. It is concluded that passenger income, and large-ship traffic congestion in Tongass Narrows are unlikely to inhibit the projected growth in large cruise ship traffic.

<sup>3</sup> Ibid., pg. 6-2.

On the other hand, it was determined that availability of cruise ship berthing space may already be limiting large cruise ship traffic, and that the limited availability of cruise ship berthing space will certainly limit future growth in large cruise ship traffic unless additional berthing space is provided.

Four factors are judged to have the potential to limit future large cruise ship traffic below projected levels:

- Limited cruise ship berthing
- Inadequate growth in destination attractions and services
- Competition from other destinations
- Tolerance of residents to growth in tourism.

Excepting resident resistance to increased growth in tourism, each of these potential limiting factors can be mitigated by appropriate investment by local, regional, and state interests, such as:

- New cruise ship berthing
- Increasing floatplanes, charter vessels, helicopters, buses, hotels, and other destination attractions and services
- Market promotion to cruise lines and to the traveling public
- In Tongass Narrows, it is concluded that one-way traffic is feasible for all foreseeable levels of cruise ship traffic. However, any low bridge would exacerbate congestion of cruise ships maneuvering in Ketchikan Harbor across East Channel.<sup>4</sup>

*Projections and Variability:* Since the preparation of the cruise ship projections for the Gravina Access Project, there have been major developments on the world economic and political scenes. The September 11, 2001 attack on the World Trade Center in New York and on the Pentagon in Washington, D.C., has set off a chain of events that has had an effect on the travel industry, and more specifically, the Alaska cruise ship industry. The issues directly affecting the Alaska cruise ship industry are the economic downturn and fear of travel, particularly air travel.

The U.S. economy had been in a slowdown prior to September 11, 2001. However, following the attacks on the World Trade Center, economic analysts generally concluded that the U.S. economy was in a recession. During periods of recession, consumer spending is lower and consumers put off expenditures on discretionary items such as travel. However, by the summer of 2002, economists felt that the U.S. economy was in a slow recovery and many economists forecasted modest economic growth for 2002. Consumer confidence levels during the summer of 2002 were not strong and there is concern in the economic community that consumers and businesses may pull back on spending.

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<sup>4</sup> Ibid, pg. 8-1.

In addition to a slow economy, the fear of air travel may create some uncertainty for future growth projections of cruise traffic. In response to the terrorist attacks on September 11, 2001, cruise lines immediately redeployed ships from ports and regions with high terrorism risk and areas where Americans may not want to travel. Additionally, cruise lines are more interested in using U.S. home ports to base ships, making it possible to drive to many cruise departure points. As a result, two additional ships were redeployed to Alaska in 2002.<sup>5</sup>

Further, several cruise lines are laying up ships for periods of time, delaying the introduction of new ships, and delaying exercising option agreements to build new ships. The uncertainty in the travel marketplace has also adversely affected the economic health of financially unstable cruise lines, resulting in the bankruptcy of two cruise lines in the fall of 2001, Renaissance Cruises and American Classic Voyages, parent company of American Hawaii Cruises and Delta Queen Steamboat. However, cruise industry analysts suggest that the growth in cruise capacity projected for the North American cruise industry overall will continue in the near term. According to one source, 2001 capacity grew by 7.7% percent and 2002 capacity grew by 4.1%. Capacity for 2003 is expected to grow by 9.0% and in 2004 by 10.8%.<sup>6</sup>

The projected growth in cruise capacity in North America, coupled with the current economic conditions and fear of travel, suggests that the cruise industry will need to make extraordinary efforts to fill ships. In general, cruise lines will schedule ships to destinations that are perceived as safe and easy to reach, and cruise prices will likely drop. It is also likely that Alaska will benefit from this situation. The primary market for Alaska cruises comes from the United States, and Alaska may be perceived as a safer cruise destination than other parts of the world. In addition, the two primary homeports for Alaska cruising are easily accessible by road and rail for much of the potential market, precluding the need for air travel. Finally, lower prices for Alaska cruises will expand the market. In spite of economic and travel concerns, indications are that the 2002 Alaska cruise season was a healthy one.

How long this growth resulting from the current conditions will last is unknown. In 1985, following a terrorism act aboard a cruise ship in the Mediterranean, Alaska experienced rapid growth in cruise passengers that continues to this day. Americans did not return to the Mediterranean for a few years. During the Gulf War, ships were also repositioned from the Mediterranean and it was two years before Americans returned to cruise in that region, according to one cruise line executive.<sup>7</sup>

Another recent development in the cruise world involves the takeover of P&O Princess by Carnival Corporation. These combined companies make the largest cruise group in the world. Together they offer several different market brands, three of which have a strong presence in Alaska. At this time, there is uncertainty as to how this merger might affect

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<sup>5</sup> Holland America announced changes in 2002 deployments and positioned the *Amsterdam* to sail to Alaska from Seattle. Celebrity Cruises repositioned one ship from the Mediterranean to Alaska.

<sup>6</sup> Cruise Industry News Annual 2002.

<sup>7</sup> Cruise Industry News, Oct. 15, 2001.

the deployment of ships to Alaska in the future, but both companies also have extensive ground tour operations and, therefore, have demonstrated a long-term commitment to the destination. In the near term, regardless of this action, the size of the cruise industry in Alaska is expected to grow.

The current economic and political conditions will continue to play a role in the future growth of Alaska as a cruise destination. A higher degree of variability in the growth projections presented could occur, at least in the short term, with the middle to high case projections more likely. It is expected, however, that the longer-term trend will be one of sustained growth as presented in the low, middle, and high cases in the Glosten memo *Cruise Ship Traffic Projections Technical Memorandum*.

### **2.3 Cruise Ship Company Interviews**

Detailed interviews with nearly every cruise line visiting Alaska in 2001 were conducted. In total, the seven cruise lines for which interviews were completed represent 97% of total passenger capacity in Alaska for 2001. In addition, a handful of detailed surveys were completed by cruise shipmasters aboard ships sailing in Alaska waters for 2001.

The results of these interviews and surveys included statements of the various effects of the different crossing options. One effect is the additional time necessary for cruise ships to sail around Gravina Island should access to Tongass Narrows be blocked by the 120-foot high bridge alternatives. Another effect is the additional maneuvering that might be needed with various other approaches to the port facilities in Ketchikan. The cruise lines provided estimates of the additional time needed to approach Ketchikan from various directions and maneuver to reach the docks. The *Interim Assessment of Cruise Industry Interviews Memorandum* (May 31, 2001) included a preliminary analysis of the information provided by the cruise lines and a limited analysis of the potential financial impact of the 120-foot high bridge alternatives. The interviews were summarized in that memo and a preliminary analysis of potential impacts was presented. The information in that memo was intended as a starting point for analysis.

### **2.4 Cruise Ship Sailing Times**

Sailing time between Ketchikan and other ports is critical in determining the effects on cruise ship operations by various access alternatives. Table 1 reviews the sailing time between Ketchikan and Juneau, the most common itinerary in Southeast Alaska.

The following was noted in the August 28, 2001 *Memo – Running time and Other Impacts on Large Cruise Ships* from Glosten Associates, Inc. to HDR Alaska, Inc.:

“The 2001 Ketchikan cruise calendar delineates 104 northbound port calls by large cruise ships and 282 southbound port calls by large cruise ships, for a total of 386 port calls (27% northbound and 73% southbound, overall). Of these, 95 northbound calls at Ketchikan proceed next to Juneau and 94 southbound calls arrive directly from Juneau. The sailing distance for large vessels operating between Ketchikan and Juneau (cruise

ship dock to cruise ship dock) is 300 n.m. via Tongass Narrows, Clarence Strait, Sumner Strait, around Cape Decision, thence up Chatham Strait to Frederick Sound, and thence Stephens Passage and finally Gastineau Channel. Of this distance, approximately 4.5 n.m. are slow sailing waters ( $\approx 3.5$  n.m. in Tongass Narrows restricted to 7 knots and approximately the final nautical mile leading to the Juneau cruise ship dock). Approximately 15 minutes must be allowed for casting off and getting underway. And likewise 15 minutes must be allowed for maneuvering to berth and making fast. Making these allowances, a mean transit speed can be computed for each vessel calling at Ketchikan that is either arriving from or departing to Juneau.”<sup>8</sup>

Using the 2001 cruise season as a base year, the average sailing time between the two ports when going northbound (Ketchikan to Juneau) was 16.56 hours. For southbound voyages the trip is, on average, slightly shorter. Average speed is calculated and compared with the maximum cruising speed. Maximum cruising speed is estimated as 90% of the maximum sea speed.<sup>9</sup> The above referenced memo concludes with the following:

“In any event, it can be seen that the large cruise ships are currently operating between Ketchikan and Juneau at approximately 95% of estimated maximum cruising speed. Given that the average estimated maximum cruising speed is somewhere between 19.99 and 20.29 knots, the remaining 5% corresponds to approximately one knot (i.e., they are operating about one knot less than the estimated maximum cruising speed in 2001). On the run between Ketchikan and Juneau, this extra one-knot might be expected to decrease running time by about 46 minutes.”<sup>10</sup>

**Table 1. Sailing Time between Juneau and Ketchikan 2001 Cruise Season**

2001 Cruise Season	Average Hours between KTN/JNU	Average Speed (knots)	Percent Max. Cruising Speed (knots)	Max. Cruising Speed (knots)	Full Sea (knots)
Ketchikan TO Juneau	16.56	19.20	94.65%	20.29	22.54
Averages – 95 trips					
Juneau TO Ketchikan – 94 trips	16.49	19.29	96.46%	19.99	22.21

Source: Running Time and Other Impacts on Large Cruise Ships, Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001

The transit between Ketchikan and Vancouver via Seymour Narrows is on average 36 hours and 48 minutes.<sup>11</sup> An analysis of this transit time suggests that it is possible to make up any time lost to a longer transit between Ketchikan and Juneau or additional

<sup>8</sup> The abbreviation “n.m.” refers to nautical miles.

<sup>9</sup> Ibid., pg. 3

<sup>10</sup> Ibid., pg. 3

<sup>11</sup> Analysis of Transits between Ketchikan and Vancouver, BC via Seymour Narrows, Technical Memorandum to HDR Alaska, Inc., by Glosten Associates, October 2002.

maneuvering time required by certain alternatives for most ships on this portion of the cruise.

An analysis of port time is presented in Table 2. The average port call is just over eight hours, with northbound ships staying one-half hour longer than southbound ships.

**Table 2. Length of Port Call Ketchikan 2001**

<b>Length of Port Call in 2001</b>	<b>Total Ship Calls</b>	<b>Northbound Calls</b>	<b>Southbound Calls</b>
6.5 hours or less	23	1	22
6.6 to 7.5 hours	86	7	79
7.6 to 8.5 hours	142	62	80
8.6 to 9.5 hours	111	25	86
9.6 hours or longer	23	9	14
Total Port Calls	385	104	281
Total Port Hours	3,140.1	881.8	2258.3
Mean Port Call	8.14	8.48	8.04
Median Port Call	8.00	8.50	8.00

Source: 2001 Ketchikan Cruise Ship Calendar, Ketchikan Visitors Bureau

Ships are scheduled in port from 5.5 hours to more than 10 hours. Usable port time is less than the actual scheduled port time. Usable port time refers to the time that is available for passengers to take tours, sightsee on their own, shop, and eat in town. Two factors drive usable port time. The first is the amount of time it takes to unload the passengers; the second is the requirement on all ships that passengers be back on board one-half hour prior to sailing time. In the May 31, 2001 memo to HDR Alaska, Inc. from Klugherz & Associates, *Interim Analysis of Cruise Industry Interviews*, an estimate of 1.5 hours of time is lost to unloading and loading a ship tied to the dock.<sup>12</sup> The memo also states, "For ships at anchor, the reboarding process is a little slower and often there are long lines to board the lightering craft to return to the vessel."<sup>13</sup> For this analysis, the figure of 1.5 hours lost port time is used as a conservative estimate. Table 3 shows usable port time for each of the current port call lengths.

**Table 3. Usable Port Hours**

<b>Length of Port Call in 2001</b>	<b>Usable Port Time</b>	<b>Current Number of Port Calls</b>
6.5 hours or less	<5.0 hours	23
6.6 to 7.5 hours	<6.0 hours	86
7.6 to 8.5 hours	<7.0 hours	142
8.6 to 9.5 hours	<8.0 hours	111
9.6 hours or longer	8.0 or more hours	23
Total Port Calls	----	385

<sup>12</sup> Interim Assessment of Cruise Industry Interviews, memo to HDR Alaska, Inc. from Klugherz & Associates, May 31, 2001, pg. 7.

<sup>13</sup> Ibid., pg. 7.

## **2.5 Vessel Simulation Studies**

Two vessel simulation studies were conducted to better understand the effects of various alternatives on cruise ship operations. The first study, known as the “*Monte Carlo Navigation Simulation Study*” prepared by Glosten Associates, assessed the navigational issues through the use of computer or “fast-time” simulations. Thousands of cases of cruise ship transits through the various Ketchikan channels were conducted in this study. A second study effort was developed in conjunction with the RTM STAR Center in Dania Beach, Florida. The real-time simulation involved the use of a full-mission simulator with a full-scale mock-up of a cruise ship bridge. Experienced sea pilots from Ketchikan participated in the study and took turns guiding the simulated cruise ships through transits of the North, East, and West channels in Tongass Narrows. A total of 144 transits were made over a three-week period. Two reports resulted from the STAR Center exercise, one is the “*Real Time Navigation Simulation Study (STAR Center) Technical Memorandum*” prepared by Glosten and Associates (October 2002). The RTM STAR Center prepared a separate report, still in draft form, of the results of the full mission simulation.

The two studies have provided measures of relative risk of the various channels in the Tongass Narrows. The real-time simulation exercise upheld the basic conclusions of the earlier fast-time Monte Carlo simulation study.

### 3.0 Effects on Cruise Ship Operations

#### 3.1 General Effects on Cruise Ship Operations

Gravina Access Project (GAP) alternatives have varying levels of effects on the cruise ship industry (Table 4). The No Action alternative, along with alternatives G2, G3, and G4 (improved ferry options), have been determined to have no direct effect on cruise ship operations. It is anticipated that traffic in Tongass Narrows, with respect to cruise ships and ferries, will continue to be consistent with existing practice.

Four of the bridge alternatives under consideration would have effects on cruise ship operations, either by preventing transit into and out of the port via the north, or by limiting transit into and out of the port via the south to only one of two currently available channels. More detailed analysis of the effects of each alternative is provided in the next sections.

**Table 4. Cruise Ship Access to Port Facilities for the GAP Alternatives**

Alternative	Description	Access
No Action	No change in service	None
C3(a)	200-foot High Bridge – Airport Area to Signal Road	None
C3(b)	120-foot High Bridge – Airport Area to Signal Road	No direct cruise vessel access to/from the north
C4	200-foot High Bridge – Airport Area to Cambria Drive Area	None
D1	120-foot High Bridge – Airport Area	No direct cruise vessel access to/from the north
F1	Pennock Island Crossing – 200-foot High Bridge East Channel & 120-foot High Bridge West Channel.	Exclusive use of East Channel for large cruise ships; use of West Channel for other traffic
F3	Pennock Island Crossing – 60-foot High Bridge East Channel & 200-foot High Bridge West Channel	Exclusive use of West Channel to/from the south
G2	Ferry Route from Peninsula Point	None
G3	Ferry Route from Downtown Ketchikan	None
G4	Ferry Route Adjacent to Existing Ferry	None

#### 3.2 Effects of C3(a) and C4

Alternatives C3(a) and C4 have a 200-foot high vertical clearance. All cruise ships currently sailing in Alaska would be able to pass under the proposed bridge, as well as those anticipated to sail to Alaska for the foreseeable future. This expectation is based on the ability of all current ships to pass under the cable at Seymour Narrows (180 feet) and the Lion's Gate Bridge (200 feet) at Vancouver, B.C.

The likelihood in the foreseeable future that a ship with an air draft greater than 185 feet would sail to Alaska is low. There are five such ships currently in service worldwide and eight more under construction, for a total of 13 ships with an air draft exceeding 185 feet. With a year-end fleet estimated to be 166 ships in 2004,<sup>14</sup> these 13 ships would represent

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<sup>14</sup> *Cruise Industry News Annual 2001*, Cruise Industry News, 2001, pg. 106.



approximately 8% of the North American cruise fleet. Ships sailing to Alaska from Seattle often transit on the outside of Vancouver Island because that route is faster, and they do not need to pass under either the Lion's Gate Bridge in Vancouver, B.C., or the cable at Seymour Narrows. Therefore, it would be possible for ships with an air draft over 200 feet to visit Alaska, using Seattle as the homeport. However, the ships being built that are over 200 feet in air draft have been designed for markets other than Alaska and no plans have been made at this time to bring these ships into the Alaska market.

### 3.3 Effects of C3(b) and D1

Gravina access alternatives C3(b) and D1 are the 120-foot high bridge alternatives. The vertical clearance for these options would preclude any large cruise ships from passing under the bridge structure. The resulting effect would be that, unless additional berthing facilities were to be built north of the proposed location for these alternatives, access to the port facilities would be from the south only (either East or West Channels). Based on interviews with cruise line executives and consultant team analysis, additional sailing time would be required for all large ship cruise itineraries that include Ketchikan. As a result of this additional sailing time and other costs, cruise line executives indicated during interviews that they would look at the possibility of either reducing port time in Ketchikan or dropping Ketchikan as a port altogether.<sup>15</sup> Further analysis was conducted by Glosten Associates to determine how much additional sailing time would be required, whether ships cruising faster could make up this time, and what the associated costs might be.

Table 5 provides an analysis of average additional time required to transit around Gravina Island on northbound and southbound voyages when ships use the maximum cruising speed between ports. Based on this analysis, the average additional time required on northbound voyages is 0.68 hours (41 minutes) and the average additional time required on southbound voyages is 0.99 hours or essentially 60 minutes.<sup>16</sup>

**Table 5. Analysis of Sailing Time between Juneau and Ketchikan Using Maximum Cruising Speed Alternatives C3(b) and D1 – Low Bridges**

2001 Cruise Season	Baseline Hours between KTN/JNU	Average Hours at Max Cruise (knots)	Average Time Lost (hours)	Average Cruising Speed	Full Sea (knots)
Ketchikan to Juneau – 95 trips	16.56	17.23	0.68	20.28	22.54
Juneau to Ketchikan – 94 trips	16.49	17.48	0.99	19.96	22.21

Source: Running Time and Other Impacts on Large Cruise Ships, Fax Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001

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<sup>15</sup> *Interim Assessment of Cruise Industry Interviews*, Memo to HDR Alaska, Inc. Klugherz & Associates, May 31, 2001

<sup>16</sup>Running Time and Other Impacts on Large Cruise Ships, *Fax Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001, pg. 5*

Table 6 provides an analysis of how the added sailing time affects the length of a port call and usable port time, using the 2001 cruise schedule as a base. Cruise lines want the ships to be in port as long as possible to maximize revenues to the ship and offset the costs of coming to the port. Cruise lines generate considerable revenues from shore excursions sold on board each ship. Therefore, they want to sell as many shore excursions as possible and have time available for the longest excursions. The longest shore excursion in Ketchikan is charter fishing, which is four to five hours, depending on the operator. Charter fishing is one of the higher-priced and very popular shore excursions, yielding high revenues for the ship. Further, cruise lines want to sell more than one shore excursion or have several departures times for the same excursion, if possible. If a ship is in a port longer, it is possible to offer longer and more profitable shore excursions, and more departures. Cruise industry executives who were interviewed were of the opinion that four hours of usable port time are necessary for a ship to stop in Ketchikan.

**Table 6. New Port Call Length – Northbound (NB) and Southbound (SB) Voyages  
Alternatives C3(b) and D1 – Low Bridges**

Length of Port Call in 2001	Current Number of Port Calls	NB	NB	SB	SB
		New Length of Port Call	Usable Port Time	New Length of Port Call	Usable Port Time
6.5 hours or less	23	<5.8 hours	<4.3 hours	<5.5 hours	<4.0 hours
6.6 to 7.5 hours	86	<6.8 hours	<5.3 hours	<6.5 hours	<5.0 hours
7.6 to 8.5 hours	142	<7.8 hours	<6.3 hours	<7.5 hours	<6.0 hours
8.6 to 9.5 hours	111	<8.8 hours	<7.3 hours	<8.5 hours	<7.0 hours
9.6 hours or longer	23	9 to 10 hours	8 to 9 hours	9 to 10 hours	8 to 9 hours

During interviews with marine specialists at each cruise line, concern was expressed regarding low bridges and the associated operational differences from current operations.

“Each marine specialist interviewed indicated that, with a low bridge, Ketchikan would lose port calls and some port time for those ships still calling in Ketchikan. It was difficult for these marine specialists to estimate how many port calls would be lost, although one indicated that they would drop Ketchikan completely, one estimated a 50% loss, and another estimated a 20% loss. Further, all cruise lines interviewed indicated that port time would be reduced in Ketchikan rather than other ports for those ships still stopping in Ketchikan. Ketchikan ranks third, behind Juneau and Skagway, in terms of cruise line port revenue from commissions of on-board sales of shore excursions. Rather than sacrifice port revenue in the top selling ports of Juneau and Skagway, port time would likely be reduced in Ketchikan.”<sup>17</sup>

<sup>17</sup> *Interim Assessment of Cruise Industry Interviews*, Memo to HDR Alaska, Inc. from Klugherz & Associates, May 31, 2001, pg. 4.

The transit time between Vancouver, British Columbia, the primary homeport for Alaska cruises, and Ketchikan via Seymour Narrows was also analyzed. In this analysis, it was shown that nearly all cruise ships have the capability to make up the additional transit time required for the south-only access to Ketchikan, discussed earlier in this section. For northbound sailings, the ability to make up time probably does not matter, since the ships arrive in the early morning hours before shops open or shore excursions are available. These vessels would likely still need to shorten the port call to make up for the additional transit time needed to head north from Ketchikan. For southbound sailings, however, there would be enough time en route to Vancouver to make up the additional transit time required to access Ketchikan from the south only, therefore not affecting port time.

Many variables are considered when scheduling a ship for a port, and often these variables change from year to year. This makes it difficult for cruise industry executives to be more specific about potential port call reductions based on time available in an itinerary for the port and the additional operational considerations (extra sailing time, extra fuel costs). However, for planning purposes, a number of assumptions have been made about the behavior of the cruise lines.

In order to develop estimates for potential reduced port calls the following basic assumptions have been made:

- 2001 is used as the baseline year.
- Northbound and southbound sailing patterns remain constant for the forecast period.
- The probability of reduced port calls declines as the number of usable port hours increases.
- Cruise lines will absorb the costs of additional fuel needed to run at a higher speed in order to make up any additional transit time.

Northbound Sailings: For the high case (most impact), the one northbound call with usable port time of less than 4.0 hours would be eliminated. The port call in this category under the new scenario has a usable port time of 3.3 hours, too short for the cruise ship to offer a range of shore excursions. A reduction of 50% in port calls is applied to port calls with usable port times of 4.0 and 5.0 hours. For many cruise lines, this length of usable port time is not enough to meet their targets for revenues. For port calls with usable port time of less than 6.0 hours, the reduction is estimated at 25% of port calls. For port calls with usable port time of less than 7.0 hours, the reduction is projected at 10%. There is no projected reduction in port calls with usable port time over 7.0 hours. Total projected reduction in port calls in the high case is 24.

For the base case, calls with usable port time of less than 4.0 hours would not be eliminated. In this case, it is assumed that the cruise lines would adjust the schedule to allow adequate time for a Ketchikan port call. Port calls with usable port time of 4.0 hours are projected to decline by 25%, while calls with less than 5.0 hours are projected to decline 10%. All other port call lengths are not projected to change. Total projected reduction in port calls in the base case is 8.

For the low or least impact case, no reduction in port calls is projected. For this case, it is assumed that cruise lines will make the various adjustments to maintain Ketchikan as a port of call.

**Table 7. Reduced Port Calls – Northbound Sailings Alternatives C3(b) and D1 – 120’  
Bridges at the Low, Base, and High Cases**

Length of Port Call in 2001	Current Number of Port Calls	Usable Port Time w/Reduced Port Call (round down)	Reduced Port Calls NB		
			Low Case (lowest decline in port calls)	Base Case	High Case (greatest decline in port calls)
6.5 hours or less	1	<4.0 hours	0	0	1
6.6 to 7.5 hours	7	4.0 hours	0	2	4
7.6 to 8.5 hours	62	5.0 hours	0	6	16
8.6 to 9.5 hours	25	6.0 hours	0	0	3
9.6 hours or longer	9	7.0 hours	0	0	0
Total Port Calls	104		0	8	24

Southbound Sailings: In this scenario, no reduction in port calls is anticipated in any of the cases due to the ability of the ships to make up the additional transit time required by south-only access to Ketchikan.

**Table 8. Reduced Port Calls – Southbound Sailings Alternatives C3(b) and D1 – 120’  
Bridges at the Low, Base, and High Cases**

Length of Port Call in 2001	Current Number of Port Calls	Usable Port Time w/Reduced Port Call (round down)	Reduced Port Calls SB		
			Low Case (lowest decline in port calls)	Base Case	High Case (greatest decline in port calls)
6.5 hours or less	22	<4.0 hours	0	0	0
6.6 to 7.5 hours	79	4.0 hours	0	0	0
7.6 to 8.5 hours	80	5.0 hours	0	0	0
8.6 to 9.5 hours	86	6.0 hours	0	0	0
9.6 hours or longer	14	7.0 hours	0	0	0
Total Port Calls	281		0	0	0

Table 9 summarizes the total reduction in port calls for these scenarios. Reduced port calls as a percent of the total 2001 port calls is 6% for the high case, 2% for the base case and 0% for the low case.

Additional maneuvers may be required under this alternative to position the ship in the appropriate direction for its departure. While the degree of risk has not been specifically quantified, it is assumed that there is some risk associated with turning ships in the Tongass basin in close proximity to cruise ships anchored offshore. While the newer class of cruise ships, with bow thrusters and azipod or similar propulsion systems, has increased maneuverability, the other traffic (fishing boats, pleasure craft, float planes) in the area may create additional challenges for these vessels, especially during high wind

events. It is likely that there will be a period of adjustment to the new cruising patterns necessary as a result of these alternatives that could result in fewer port calls than projected in the various cases in this analysis.

**Table 9. Total Reduced Port Calls for Alternatives C3(b) and D1 – 120' Bridges at the Low, Base & High Cases (with 2001 as base year)**

	Low Case	Base Case	High Case
Total Port Calls in 2001	385	385	385
Reduction in Northbound Port Calls	0	8	24
Reduction in Southbound Port Calls	0	0	0
Total Reduction in Port Calls	0	8	24
Revised Port Calls Using 2001 as Base	385	377	361
Reduced Port Calls as % of Total 2001 Port Calls	0%	2%	6%

For the ships that continue to visit Ketchikan, port time is estimated to be reduced on average 0.68 hours (41 minutes) for northbound sailings. Southbound sailings will need to make up 0.99 hours (one hour) of additional transit time used to access the port. This transit time can be made up from Ketchikan to Vancouver. Therefore, only northbound sailings are anticipated to reduce port time in Ketchikan.

Total port time reductions are presented in Table 10 using the reduced time estimates. The low case represents no reduction in port calls, but has the largest reduced port time (71 hours) due to the fact that more ships will be reducing port time than in the high case scenario.

**Table 10. Total Reduced Port Time for Alternatives C3(b) and D1 – 120' Bridges at the Low, Base & High Cases (with 2001 as base year)**

	Low Case	Base Case	High Case
Total Remaining Port Calls	385	377	361
Remaining Northbound Port Calls	104	96	80
Northbound Port Time Reduction (41 minutes/call)	71.0 hours	65.6 hours	54.7 hours

**Another effect is the added cost of fuel for the additional sailing time and the additional power needed to cruise at the necessary cruising speeds. For purposes of this analysis, it has been assumed that cruise lines will absorb these additional costs.**

Table 11 provides an analysis of the additional fuel and estimated costs to make up the transit time necessary to keep to the sample 2001 schedule.

**Table 11. Additional Fuel and Associated Costs for Alternatives  
C3(b) and D1 – 120' Bridges**

	Northbound	Southbound
Estimated Extra Fuel Needed KTN/JNU (Avg./Sailing)	4,594 Gallons	2,712 Gallons
Estimated Extra Fuel Needed KTN/Vancouver (Avg./Sailing)	0 Gallons	1,950 Gallons
Total Estimated Extra Fuel Needed	4,594 Gallons	4,662 Gallons
Estimated Cost Per Gallon	\$1.00	\$1.00
Estimated Additional Cost Per Sailing	\$4,594	\$4,662

Source: Running Time and Other Impacts on Large Cruise Ships, Fax Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001; Analysis of Cruise Ship Transits between Ketchikan and Vancouver, BC via Seymour Narrows, Glosten Associates, October 2002.

Using a weighted average of northbound (104) and southbound (281) sailings, the total average estimated additional fuel cost per sailing is \$4,644. Using the revised port call figure after reductions, the cost for the additional sailing time and increased speed can be calculated for each scenario. This assumes that the cruise line elects to maximize the port time by cruising between Ketchikan and Juneau at maximum cruising speed and between Vancouver and Ketchikan at increased speeds. Further, fuel costs have not been estimated for ships to call at other ports if they choose to skip Ketchikan.

**Table 12. Additional Fuel Costs for Alternatives C3(b) and D1 – 120' Bridges**

	Low Case	Base Case	High Case
Revised Port Calls Using 2001 as a Base	385	377	361
Estimated Average Additional Cost Per Port Call	\$4,644	\$4,644	\$4,644
Total Estimated Additional Fuel Cost (rounded)	\$1,787,900	\$1,750,800	\$1,676,500

Table 13 summarizes the effects on cruise ship operations from Gravina Access Project alternatives C3(b) and D1.

**Table 13. Summary of Effects on Cruise Ship Operations for Alternatives  
C3(b) and D1 – 120' Bridges**

	Low Case	Base Case	High Case
Reduced Port Calls	0	8	24
Reduced Port Calls as Percent of Total	0%	2%	6%
Total Additional Fuel Costs	\$1,787,900	\$1,750,800	\$1,676,500

### **3.4 Effects of F1 (Pennock Island Crossing)**

Alternative F1 includes a 200-foot high bridge over East Channel and a 120-foot high bridge over West Channel. The 200-foot high bridge over East Channel provides vertical clearance for the ships sailing to Alaska for the foreseeable future. This expectation is based on the ability of all current ships to pass under the cable at Seymour Narrows (180 feet) and Lion's Gate Bridge (200 feet) at Vancouver, B.C. (While the possibility exists

for taller ships to sail to Alaska, the likelihood of this happening is low; see Section 3.2). Accessing Ketchikan via East Channel is the current practice by large cruise ships. There will be closures of East Channel during construction.

### **3.5 Effects of F3 (Pennock Island Crossing)**

Alternative F3 includes a 60-foot high bridge over East Channel and a 200-foot high bridge over West Channel, the southern approaches to Ketchikan cruise ship facilities. This alternative would require the exclusive use of West Channel for all cruise ships. Current usage of West Channel by large cruise ships is estimated at 10 times per season. East Channel is the preferred approach to the cruise ship docks, as it is in nearly direct alignment, while West Channel requires additional maneuvering in Tongass Basin to berth.

When interviewed, cruise line executives and ships masters were generally uncomfortable with the use of West Channel exclusively. As a matter of company policy, some cruise lines do not allow their ships to use West Channel. The primary concern mentioned was the additional time needed to maneuver into and out of the channel.<sup>18</sup>

There is navigational risk with all approaches into Ketchikan, whether from the north, West Channel, or East Channel. Estimates developed from two cruise ship simulation studies (one fast-time and one real-time) simulating cruise ship operations in East, West, and North Channels indicated “. . . a comparable risk of grounding in East Channel at Idaho/California Rocks and in West Channel north of buoy G”5”.<sup>19</sup> The natural widths of East and West Channels are similar at their narrowest points, 477 feet and 476 feet, respectively. The simulation study results also point out that the minimum clearance in East Channel is at one point only, while minimum clearance in West Channel lasts for approximately 2500 feet.

During the real-time simulation study “. . . the pilots found the transit of West Channel to be more stressful, difficult and unsafe than transits of East Channel.”<sup>20</sup> However, the study also concluded that “. . . there is a significant difference in the perception of risk of using West Channel and the statistics of risk based on pilot performance in West Channel.”<sup>21</sup>

An analysis conducted by Glosten Associates, Inc. assessed the timing effects of alternative F3, where East Channel was blocked to large cruise ships by a 60-foot bridge and West Channel was the alternative passage. Assuming that cruise ships would use West Channel, the resulting sailing time differential is analyzed in Table 14.

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<sup>18</sup> *Interim Assessment of Cruise Industry Interviews*, Memo to HDR Alaska, Inc. Klugherz & Associates, May 31, 2001

<sup>19</sup> Glosten Associates, Inc., *Real Time Navigation Simulation (STAR Center) Study (Draft – Rev C.)*, Draft, October 2002, pg. 19.

<sup>20</sup> *Ibid*, pg 48.

<sup>21</sup> *Ibid*, pg 48.

“Presuming a low bridge across East Channel south of the existing Ketchikan cruise ship docks and a willingness by large cruise ships to use West Channel adds approximately 1.8 n.m. to the running distance and cruise ships would have to execute the equivalent of two 180° turns that is currently not required, adding 30 to 40 minutes to their harbor maneuvers.”<sup>22</sup>

The average increase in total running time on northbound voyages would be a negligible 0.05 hours (3 minutes) and the average increase in total running time on southbound voyages would be 0.30 hours (18 minutes).<sup>23</sup> It is important to note that the increased time is actually much greater than 3 minutes or 18 minutes but, by employing faster running speeds between Juneau and Ketchikan, much of the time can be reduced. These faster running speeds consume more fuel, resulting in increased fuel costs.

**Table 14. Analysis of Sailing Time between Juneau and Ketchikan for Alternative F3 – Pennock Island Crossing**

<b>2001 Cruise Season</b>	<b>Baseline Hours between KTN/JNU</b>	<b>Average Hours at Max Cruise (knots)</b>	<b>Average Time Lost (hours)</b>	<b>Average Cruising Speed</b>	<b>Full Sea (knots)</b>
Ketchikan TO Juneau – 95 trips	16.56	16.60	0.05	20.01	22.54
Juneau TO Ketchikan – 94 trips	16.49	16.79	0.30	19.76	22.21

Source: Running Time and Other Impacts on Large Cruise Ships, Fax Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001.

Further analysis of transit time between Vancouver and Ketchikan via Seymour Narrows was conducted to assess whether cruise ships could make up the increases in transit times on both northbound and southbound voyages. The results of this analysis suggest that with small increases in cruising speed, the increases in transit time needed could be made up on this leg of the journey. Therefore, no port time would be lost.<sup>24</sup>

Many variables are considered when scheduling a ship for a port, and often these variables change from year to year. This makes it difficult for cruise industry executives to be more specific about potential reductions in port calls based on the time available in an itinerary for the port and the additional operational considerations (extra sailing time, extra fuel costs, etc.). It also makes it difficult to project what may happen to cruise ship traffic with various bridge alternatives. However, for planning purposes, scenarios reflected different cruise ship traffic levels have been developed for the F3 option.

The first step in developing the scenarios for future Ketchikan port calls with ships using West Channel exclusively is to develop estimates of the percentage of ships that would continue to use West Channel. The second step is to develop estimates of the percentage

<sup>22</sup> Running Time and Other Impacts on Large Cruise Ships, *Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001*. The abbreviation “n.m.” refers to nautical miles.

<sup>23</sup> *Ibid.*, pg. 7.

<sup>24</sup> Analysis of Cruise Ship Transits between Ketchikan and Vancouver, BC, via Seymour Narrows, Glosten Associates for HDR Alaska, Inc., October 2002.



of ships that would access Ketchikan from the north only versus those that would choose to bypass Ketchikan altogether. In order to develop these scenarios, the following base assumptions were used:

- 2001 is the baseline year.
- Northbound and southbound sailing patterns remain constant for the study period.
- All northbound ships can make the existing schedule using West Channel or North Channel.
- Nearly all southbound ships can make the existing schedule using West Channel.
- The probability of reduced port calls is primarily influenced by the perception of safety in transiting West Channel. Some ships that do not use West Channel will choose to access Ketchikan from the north.
- The probability of reduced port calls declines as the number of usable port hours increases.
- Cruise lines will increase the cruising speeds and pay the additional fuel costs to meet the existing schedules.

These base assumptions do not include other reasons that ships may bypass Ketchikan, including the development of new itineraries that utilize other areas and ports in Alaska or Canada. Ketchikan has supported the cruise industry with infrastructure and other shore-based developments in order to secure the business of the cruise industry. Other ports and destinations in British Columbia and Alaska are also developing and improving infrastructure, creating a more competitive atmosphere. Therefore, the possibility always remains that cruise lines may substitute other ports and destinations.

Table 15 and Table 16 outline scenarios in which ships choose not to use West Channel and instead bypass Ketchikan. In the high or most impact case, 50% of ships with 4 hours of usable port time, 25% of ships with 5 and 6 hours of usable port time, 10% of ships with 7 hours of usable port time, and 5% of ships with 8 hours of usable port time would forego use of West Channel and bypass Ketchikan. The projected reduction in the total number of port calls is 22 for northbound sailings and 61 for southbound sailings.

For the base case, 25% of ships with 4.0 hours of usable port time would choose to not use West Channel, along with 15% of ships with 5.0 hours, 10% of ships with 6.0 hours, and 5% of the ships with 7 or more hours. The resulting projected number of reduced port calls for ships not using West Channel is 8 for northbound sailings and 31 for southbound.

For the low or least impact case, it is assumed that all ships would use West Channel and continue to visit Ketchikan. Therefore, no reductions are projected for the low case for either northbound or southbound sailings.

**Table 15. Ships Not Using West Channel – Northbound Sailings Low, Base, and High Cases – Alternative F3**

Length of Port Call in 2001	Current Number of Port Calls	Usable Port Time w/Reduced Port Call (round down)	Ships Not Using West Channel NB		
			Low Case (fewest ships not using W.C.)	Base Case	High Case (most ships not using W.C.)
6.5 hours or less	1	4.0 hours	-	-	1
6.6 to 7.5 hours	7	5.0 hours	-	1	2
7.6 to 8.5 hours	62	6.0 hours	-	6	16
8.6 to 9.5 hours	25	7.0 hours	-	1	3
9.6 hours or longer	9	8.0 hours	-	-	-
Total Port Calls	104		-	8	22

NB = northbound  
W.C. = West Channel

**Table 16. Ships Not Using West Channel – Southbound Sailings - Low, Base, and High Cases –Alternative F3**

Length of Port Call in 2001	Current Number of Port Calls	Usable Port Time w/Reduced Port Call (round down)	Ships Not Using West Channel SB		
			Low Case (fewest ships not using W.C.)	Base Case	High Case (most ships not using W.C.)
6.5 hours or less	22	4.0 hours	-	6	11
6.6 to 7.5 hours	79	5.0 hours	-	12	20
7.6 to 8.5 hours	80	6.0 hours	-	8	20
8.6 to 9.5 hours	86	7.0 hours	-	4	9
9.6 hours or longer	14	8.0 hours	-	1	1
Total Port Calls	281		-	31	61

SB = southbound  
W.C. = West Channel

Among the ships that choose not to use West Channel, some will likely choose to access the Ketchikan docks from the north, necessitating a trip around Gravina Island. This transit around the island takes approximately 30 to 40 minutes. The additional transit time can be absorbed into the existing schedule with slightly higher cruising speeds.<sup>25</sup>

Table 17 and Table 18 provide scenarios for those ships that do not use West Channel.

In the high or most impact case, it is assumed that ships with 4.0 hours of usable port time would most likely skip Ketchikan rather than access the harbor from the north. It is further assumed that 25% of ships with 4 hours to 6 hours of usable port time would visit Ketchikan, along with 50% ships with 7 hours or more of usable port time. The result is that 26 of 83 ships not using West Channel will still visit Ketchikan. Total projected reduction, therefore, is 57 port calls (see Table 19).

<sup>25</sup> Analysis of Cruise Ship Transits between Ketchikan and Vancouver, BC, via Seymour Narrows, Glosten Associates, Inc., for HDR Alaska, Inc., October 2002.

In the base case, it is assumed that 50% of ships with 4 to 6 hours of usable port time would visit Ketchikan, while 75% of ships with 7 or more hours of usable port time would visit Ketchikan. The result is that 22 out of 39 ships not using West Channel will still visit Ketchikan. Total projected reduction is therefore 17 port calls (see Table 19).

In the low or least impact case, it is assumed that all ships will use West Channel; therefore, all ships would visit Ketchikan.

**Table 17. Ships Accessing Ketchikan From North – Northbound Sailings Low, Base, and High Cases - Alternative F3**

Length of Port Call in 2001	Current Number of Port Calls	Usable Port Time w/Reduced Port Call (round down)	Ships Accessing Ketchikan From North NB		
			Low Case	Base Case	High Case
6.5 hours or less	1	4.0 hours	-	-	-
6.6 to 7.5 hours	7	5.0 hours	-	1	1
7.6 to 8.5 hours	62	6.0 hours	-	3	4
8.6 to 9.5 hours	25	7.0 hours	-	1	2
9.6 hours or longer	9	8.0 hours	-	-	-
Total Port Calls	104		-	5	7

**Table 18. Ships Accessing Ketchikan from North – Southbound Sailings - Low, Base, and High Cases –Alternative F3**

Length of Port Call in 2001	Current Number of Port Calls	Usable Port Time w/Reduced Port Call (round down)	Ships Accessing Ketchikan from North SB		
			Low Case	Base Case	High Case
6.5 hours or less	22	4.0 hours	-	3	3
6.6 to 7.5 hours	79	5.0 hours	-	6	5
7.6 to 8.5 hours	80	6.0 hours	-	4	5
8.6 to 9.5 hours	86	7.0 hours	-	3	5
9.6 hours or longer	14	8.0 hours	-	1	1
Total Port Calls	281		-	17	19

Table 19 summarizes the total reduction in port calls for this scenario. The reduction in port calls, as a percentage of the total 2001 port calls is 15% for the high case, 4% for the base case, and 0% for the low case.

**Table 19. Total Reduction in Port Calls Low, Base & High Cases – Alternative F3 During Initial Period**

	Low Case	Base Case	High Case
Total Port Calls in 2001	385	385	385
Reduction in Northbound Total Port Calls	0	3	15
Reduction in Southbound Total Port Calls	0	14	42
Reduction in Total Port Calls	0	17	57
Remaining Port Calls	385	368	328
Reduction in Port Calls as % of Total Port Calls	0%	4%	15%

It is anticipated that after two or three years of operation in West Channel, some of the ships that did not use the channel because of the higher perceived risk will return to Ketchikan either using West Channel or accessing the port from the north. The following table provides a summary of the projected reduction in port calls following the two- or three-year adjustment period.

**Table 20. Total Reduction in Port Calls Low, Base & High Cases,— Alternative F3 Following Adjustment Period**

	Low Case	Base Case	High Case
Total Port Calls in 2001	385	385	385
Reduction in Northbound Total Port Calls	0	2	8
Reduction in Southbound Total Port Calls	0	6	21
Reduction in Total Port Calls	0	8	29
Remaining Port Calls	385	377	356
Reduction in Port Calls as % of Total Port Calls	0%	2%	8%

Potential effects presented in the above table reflect a range of possibilities – from no effect to as much as 8% reduction in port calls. This range is provided because the possibility exists that some ships will not use West Channel in the long term because of perceived risk. Further, it remains possible that some ships will drop Ketchikan because of this risk. It is also possible that the potential effects could be greater if cruise lines do not choose to pay the additional fuel costs necessary to make the existing schedule or other cruise ports that better meet the economic goals of the cruise line become available. Certain work (i.e., dredging/channel modification) in West Channel could be undertaken to improve navigational clearances in West Channel and mitigate the risks of transiting West Channel. If this were to happen, then the potential effects of F3 may be represented in the low or base cases.

Because it is anticipated that cruise lines will make up the additional transit time needed to utilize West Channel or North Channel, no reduction in port time is expected. However, an effect of the additional sailing and maneuvering time is the added cost of fuel for speeding up the transits between Ketchikan and other ports. Table 21 provides an analysis of the additional fuel and estimated cost for the trip between Ketchikan and Juneau and Ketchikan and Vancouver for the use of West Channel.

**Table 21. Additional Fuel and Associated Costs for Alternative F3 – Pennock Island Crossing**

	Northbound	Southbound
Estimated Extra Fuel Needed KTN/JNU (Avg./Sailing)	3,579	2,055
Estimated Extra Fuel Needed KTN/Vancouver (Avg./Sailing)	1,255	1,483
Estimated Cost Per Gallon	\$1.00	\$1.00
Estimated Additional Cost Per Sailing	\$4,834	\$3,538

Source: Running Time and Other Impacts on Large Cruise Ships, Fax Memo to HDR Alaska, Inc., Glostien Associates, August 28, 2001

Using a weighted average of northbound (104) and southbound (281) sailings, the total average estimated additional fuel cost per sailing is \$3,888. Using the remaining port call estimate, and assuming all remaining ships will need to travel the additional 1.8 nautical miles, the cost for the additional sailing time and increased speed can be calculated for each scenario. This assumes that the cruise line elects to minimize the potential reduction in port time by cruising between Ketchikan and Juneau or Vancouver at increased speeds. The tables below outline the additional fuel costs during the initial period of the bridge and after an adjustment period.

**Table 22. Additional Fuel Costs for Alternative F3 – Initial Period**

	Low Case	Base Case	High Case
Revised Port Calls Using 2001 as a Base	385	368	328
Estimated Average Additional Cost Per Port Call	\$3,888	\$3,888	\$3,888
Total Estimated Additional Fuel Cost (rounded)	\$1,496,900	\$1,430,800	\$1,275,300

**Table 23. Additional Fuel Costs for Alternative F3 –After Adjustment Period**

	Low Case	Base Case	High Case
Revised Port Calls Using 2001 as a Base	385	377	356
Estimated Average Additional Cost Per Port Call	\$3,888	\$3,888	\$3,888
Total Estimated Additional Fuel Cost (rounded)	\$1,496,900	\$1,465,800	\$1,384,100

The above tables (Table 22 and Table 23) assume all ships would use West Channel. For ships accessing Ketchikan using North Channel,<sup>1</sup> fuel costs would be greater than those estimated in the above tables. Estimated fuel usage is 4,665 gallons per sailing for southbound ships and 4,636 gallons per sailing for northbound ships for transit between Ketchikan and Vancouver using North Channel. In addition, southbound ships will use additional fuel to cruise at a faster speed between Ketchikan and Vancouver to make up the additional transit time between Juneau and Ketchikan.

**Table 24 summarizes the initial effects on cruise ship operations from Gravina access alternative F3, with the assumption that large cruise ships would use West Channel.**

Table 25 summarizes the effects on cruise ship operations for this alternative after an adjustment period.

**Table 24. Summary of Initial Effects of Alternative F3 (using 2001 as Base Year)**

	Low Case	Base Case	High Case
Reduction in Port Calls	0	17	57
Reduced Port Calls as Percent of Total	0%	4%	15%
Total Additional Fuel Costs	\$1,496,900	\$1,430,800	\$1,275,300

**Table 25. Summary of Adjusted Effects of for Alternative F3 (using 2001 as Base Year)**

	<b>Low Case</b>	<b>Base Case</b>	<b>High Case</b>
Reduction in Port Calls	0	8	29
Reduced Port Calls as Percent of Total	0%	2%	8%
Total Additional Fuel Costs	\$1,496,900	\$1,465,800	\$1,384,100

## 4.0 Effects on Passenger Activities and Other Spending

### 4.1 Background

Cruise ship-related spending on shore is found in three forms. The first is the spending by cruise ship passengers for tours, sightseeing, gifts, souvenirs, food, and beverages. The second form of spending involves the purchases made by cruise ship crews. The third form is direct spending by the cruise line itself for docking, tugs, pilots, and miscellaneous supplies. The following subsection illustrates the estimated spending by cruise ship passengers, crews, and cruise lines based on 1999 data.

#### *Cruise Ship-Related Spending On Shore*

Based on a study completed for the Southeast Conference in 2000, cruise ship passengers were estimated to spend, on average, \$95 per person per port call in Ketchikan. Cruise ship crews were estimated to spend \$15 per person, and cruise lines a total of \$22,100 per visit. Using the average capacity per ship in 2001 for passengers and crew, the total value of a cruise ship call is calculated at \$191,080.

**Table 26. Estimate of Cruise Ship-Related Spending Per Port Call**

	Average Passengers Per Ship	Average Spending	Total Spending/Call
Cruise Ship Passengers	1,664	\$95	\$158,080
Cruise Ship Crew	727	\$15	\$ 10,900
Cruise Line Spending	--	--	\$ 22,100
Total			\$191,080

Source: Economic Impact of Cruise Line Spending in Southeast Alaska in 1999, Southeast Conference, 2000.

While average passenger spending is estimated to be \$95 per passenger per Ketchikan port call, estimates for passenger spending by the length of port call have not been available. For purposes of this analysis, estimates of passenger spending by length of port call have been made to better assess the potential impacts of fewer port calls and shorter port calls. These estimates were developed based on the amount of time in port (by half-hour increments), the number of passengers in each time slot, and an estimated per passenger spending figure. It was assumed that the shorter the port call, the lower the spending. Conversely, it was also assumed that the longer the port call, the greater the spending. Table 27 provides these estimates for purposes of this analysis.

**Table 27. Estimate of Cruise Ship-Related Spending By Length of Port Call**

Port Call Length 2001	Usable Port Hours	Estimated Average Spending
6.5 hours or less	4.0	\$70.11
6.6 to 7.5 hours	5.0	\$80.00
7.6 to 8.5 hours	6.0	\$95.00
8.6 to 9.5 hours	7.0	\$105.00
9.6 or more hours	8.0	\$117.31

## 4.2 Effects of Passenger Activities and Other Revenues

### 4.2.1 *Effects on Passenger Activities and Other Spending of No Action, G2, G3, and G4 Alternatives*

There are no effects on passenger activities and other spending as a result of alternatives G2, G3, and G4. It is anticipated that traffic in Tongass Narrows will continue to function as it currently does for the foreseeable future.

### 4.2.2 *Effects on Passenger Activities and Other Spending of C3(a) and C4*

These two alternatives are of sufficient vertical clearance to permit the passage of large cruise ships and, therefore, there is no loss of projected port calls or usable port time. As a result, there are no anticipated effects on passenger activities and other spending.

### 4.2.3 *Effects on Passenger Activities and Other Spending of C3(b) and D1 – Low Bridges*

The effects of the low bridge alternatives on passenger activities and other spending are greater than any other alternative. Table 28 demonstrates the potential reduction in spending resulting from alternatives C3(b) and D1. In each case, the value of a cruise ship call is \$191,080. The potential annual reduction in spending resulting from fewer port calls for alternatives C3(b) and D1 range from no change in the low case to nearly \$4.6 million in reduced spending in the high case, using 2001 as a base year.

**Table 28. Potential Reduction in Spending Low, Base, and High Cases –  
Alternatives C3(b) and D1**

	Low Case	Base Case	High Case
Northbound Sailings			
Reduced Port Calls	0	8	24
Potential Spending Reduction	\$0	\$1,528,600	\$4,585,900
Southbound Sailings			
Reduced Port Calls	0	0	0
Potential Spending Reduction	\$0	\$0	\$0
Total			
Reduced Port Calls	0	8	24
Potential Spending Reduction	\$0	\$1,528,600	\$4,585,900

While information exists on average passenger spending per port call in Ketchikan, there is no current information available on passenger spending per hour that a ship is in port. Spending by cruise passengers will vary by ship, by length of time in port, by direction of the cruise (i.e., northbound versus southbound), and other factors such as poor weather.

In order to assess the potential effects of lost port time by those ships visiting Ketchikan, a number of assumptions have been made about spending by usable hours in port. Assuming that passenger spending varies by hour, with more spending occurring early in the port call than later, and that the shore excursion spending is counted in the first hour, an estimate can be made of spending by hour. For ships with longer usable port time it is



assumed that the second wave of shore excursion spending is reflected in the fourth hour. Using these assumptions, Table 29 provides an estimate of passenger spending while in port.

**Table 29. Estimated Passenger Spending by Hour**

	Usable Port Time				
	4.0 hours	5.0 hours	6.0 hours	7.0 hours	8.0 or more
Hour					
1	55%	55%	50%	40%	40%
2	25%	20%	15%	10%	10%
3	15%	15%	15%	10%	10%
4	5%	5%	10%	20%	20%
5	-	5%	5%	10%	10%
6			5%	5%	5%
7				5%	5%
8+					
Total	100%	100%	100%	100%	100%

Table 30 applies these spending estimates per hour to the spending estimates developed in Table 27.

**Table 30. Estimated Passenger Spending by Hour**

	Usable Port Time				
	4.0 hours	5.0 hours	6.0 hours	7.0 hours	8.0 or more
Hour					
1	\$38.56	\$44.00	\$47.50	\$42.00	\$46.92
2	\$17.53	\$16.00	\$14.25	\$10.50	\$11.73
3	\$10.52	\$12.00	\$14.25	\$10.50	\$11.73
4	\$3.51	\$4.00	\$9.50	\$21.00	\$23.46
5		\$4.00	\$4.75	\$10.50	\$11.73
6			\$4.75	\$5.25	\$5.87
7				\$5.25	\$5.87
8+					
Total	\$70.11	\$80.00	\$95.00	\$105.00	\$117.31

Further assumptions were made to calculate potential reductions in passenger spending. These reductions were calculated by using total port calls remaining for each usable port hour category and by using the assumption that the last hour of spending calculated in the above table would be lost in each scenario, except for those passengers with eight or more hours of usable port time. These calculations used the average number of passengers per port call, times the number of port calls, times the amount of spending in the last hour to develop the final figures. For example, in the high case, one port call remained in the lowest usable port time category (less than four hours). This port call was multiplied by the average number of passengers and the estimated amount of spending in the fourth hour (\$3.51). The result for the less than four-hour category is \$8,500 of reduced spending for the port call. This formula was applied to each hour for each case

for northbound sailings only. (Southbound sailings were not assumed to have any reduced port time). The resulting calculations are found in Table 31.

In the table, the low case reflects \$735,000 in reduced spending, the base case \$683,100, and the high case approximately \$575,500. In this analysis, the high case actually reflects the least amount of spending lost, because it reflects the lowest number of reduced-time port calls. These port calls were calculated in section 3.3 *Effects of C3(b) and D1*, and the cases were based on the number of port calls lost. Hence, in the high case, the greatest reduction in the number of port calls occurs, leaving the fewest number of port calls. Because the port calls are fewer, the total number of lost hours is fewer and the total reduction in spending is lower.

**Table 31. Passenger Spending Reductions with Less Port Time for Alternatives C3(b) and D1**

	Low Case	Base Case	High Case
Remaining Port Calls	385	377	361
Total Reduction in Spending	\$734,700	\$683,100	\$575,500

Table 32 summarizes the effects on passenger and other expenditures from Alternatives C3(b) and D1 using 2001 as a baseline year. The high case reflects a \$5.2 million reduction, the base case a \$2.2 million reduction, and the low case an estimated \$0.7 million reduction from these alternatives.

**Table 32. Summary – Reduction in Passenger and Other Spending  
2001 Base Year - Alternatives C3(b) and D1**

	Low Case	Base Case	High Case
Total Spending Reduction from Fewer Port Calls	\$0	\$1,528,600	\$4,585,900
Spending Reduction from Fewer Hours in Port	\$734,700	\$683,100	\$575,500
Total Reduction in Spending	\$734,700	\$2,211,700	\$5,161,400

#### ***4.2.4 Effects on Passenger Activities and Other Spending of F1***

This alternative is of sufficient vertical clearance to permit the passage of large cruise ships and, therefore, there is no reduction in projected port calls or usable port time. As a result, there are no anticipated effects on passenger activities and other spending. However, there is the possibility that East Channel may experience periods of closure during one year of the construction period. The timing and potential effects of these closures is unknown at this time.

#### ***4.2.5 Effects on Passenger Activities and Other Spending of F3***

Passenger activities and other revenues will be affected by alternative F3. Table 33 and Table 34 demonstrate the potential spending reductions resulting from this alternative during the initial period and after an adjustment period. In each case, the value of a cruise ship call remains constant at \$191,080.

During the initial period of up to three years, the potential spending reductions resulting from fewer port calls for this alternative range from no change in the low case to a reduction of \$3.4 million in the base case and \$10.9 million in the high case, using 2001 as the base year. After the adjustment period, the potential spending reductions range from no change in the low case to a reduction of \$1.5 million in the base case and \$5.5 million in the high case.

**Table 33. Potential Spending Reductions for Alternative F3 – Pennock Island Crossing During the Initial Period**

	Low Case	Base Case	High Case
Northbound Sailings			
Reduction in Port Calls	0	3	15
Potential Spending Reduction	\$0	\$573,200	\$2,866,200
Southbound Sailings			
Reduction in Port Calls	0	14	42
Potential Spending Reduction	\$0	\$2,675,100	\$8,025,400
Total			
Reduction in Port Calls	0	17	57
Potential Spending Reduction	\$0	\$3,428,300	\$10,891,600

**Table 34. Potential Spending Reductions for Alternative F3 – Pennock Island Crossing After Adjustment Period**

	Low Case	Base Case	High Case
Northbound Sailings			
Reduction in Port Calls	0	2	8
Potential Spending Reduction	\$0	\$381,100	\$1,528,600
Southbound Sailings			
Reduction in Port Calls	0	6	21
Potential Spending Reduction	\$0	\$1,146,500	\$4,012,700
Total			
Reduction in Port Calls	0	8	29
Potential Spending Reduction	\$0	\$1,528,600	\$5,541,300

Because it is anticipated that cruise lines will make up the additional transit time needed to utilize West Channel or North Channel, no reduction in port time is expected, therefore no reduction in port revenue is calculated.

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